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(56) Documents Cited
GB 0621427 A EP 0591601 A1 EP 0495440 A2
EP 0405472 A1 US 5655687 A US 5071017 A

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Online: WPI

(54) Abstract Title
Dispensing valve with a slitted diaphragm and retention ring

(57) A valve for dispensing viscous fluid includes a resilient diaphragm 1 with a self-closing slit 4 and a diaphragm retention ring 30 with a peripheral portion for engaging a dispensing aperture of a container. The diaphragm may be substantially planar with a single straight slit, and may bulge outwardly during dispensing. The valve may be part of a screw-threaded cap 50, and the retention ring may have circumferential protrusions (35, fig 3) which aid locking of the retention ring to the cap to prevent distortion of the diaphragm when the cap is screwed onto the container.

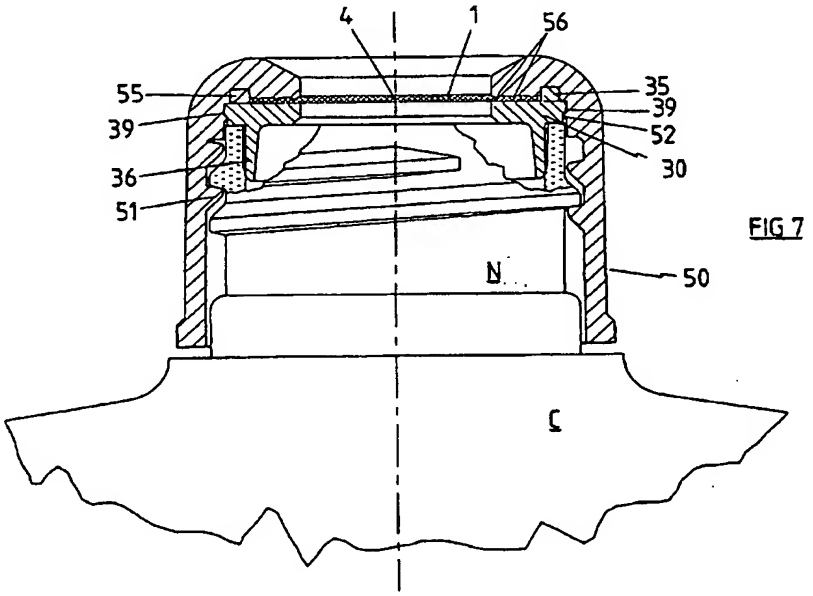

FIG 7

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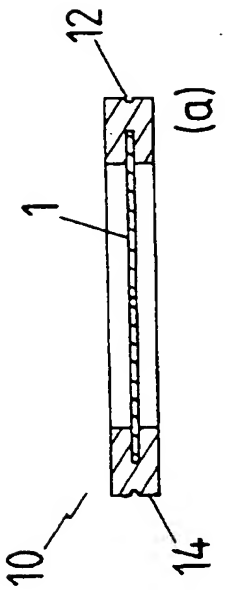
At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.



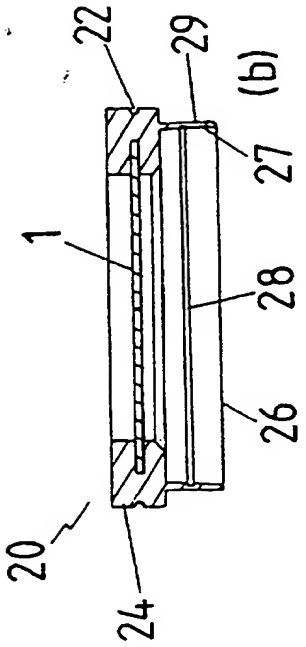


FIG 2

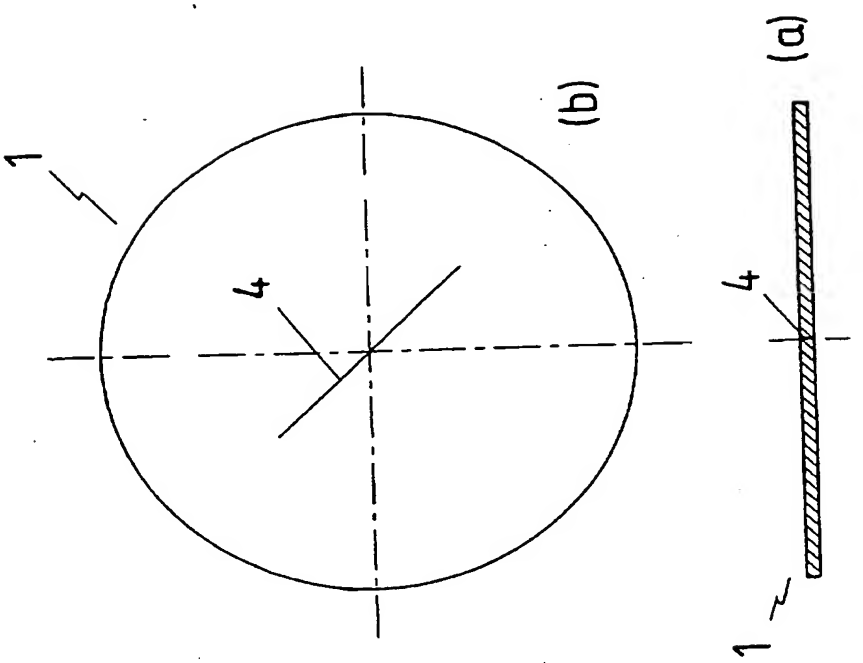


FIG 1

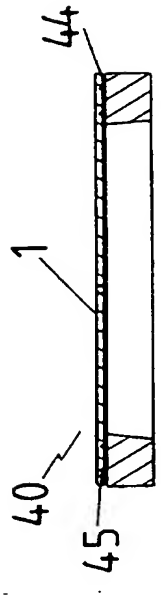


FIG 4

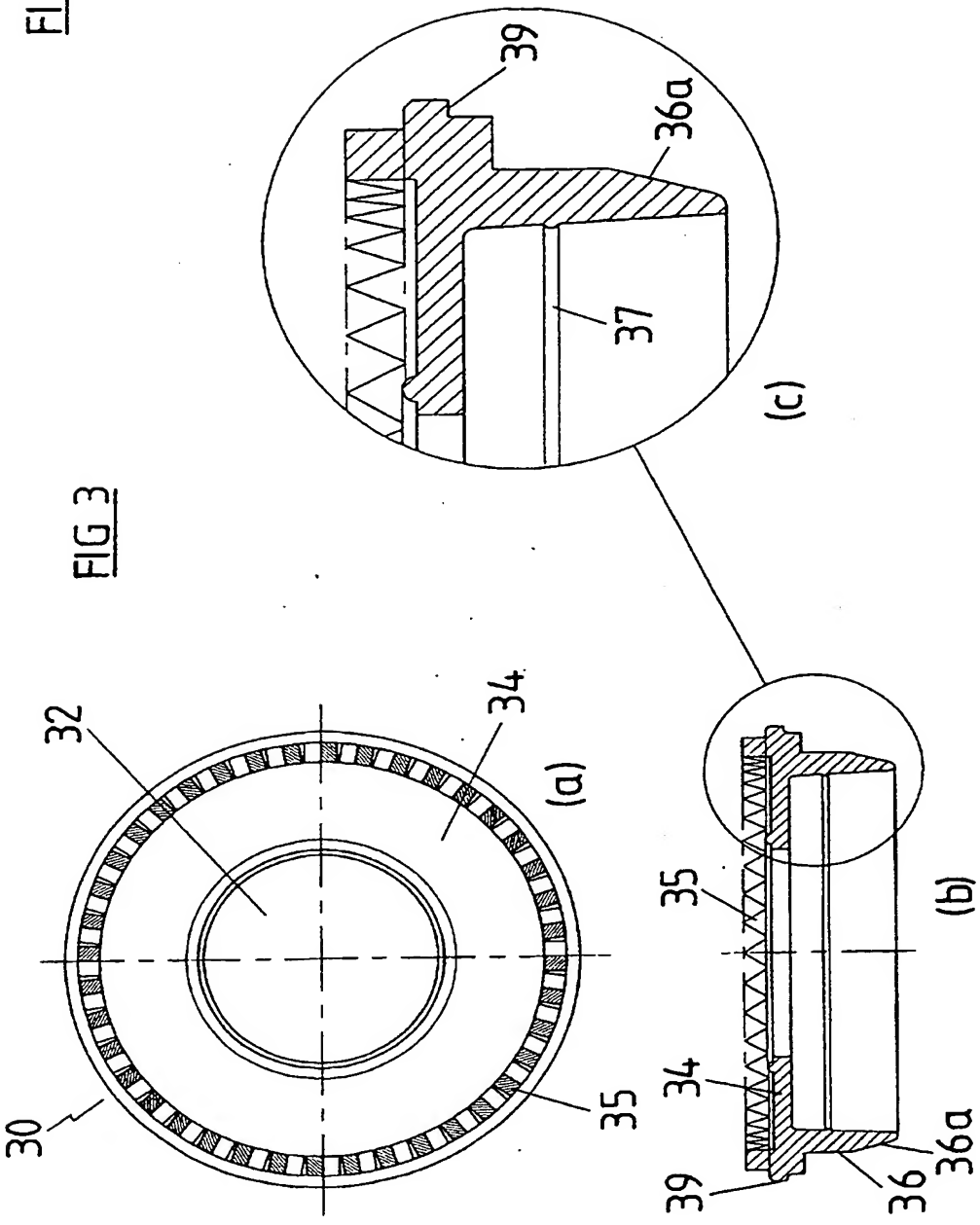


FIG 3

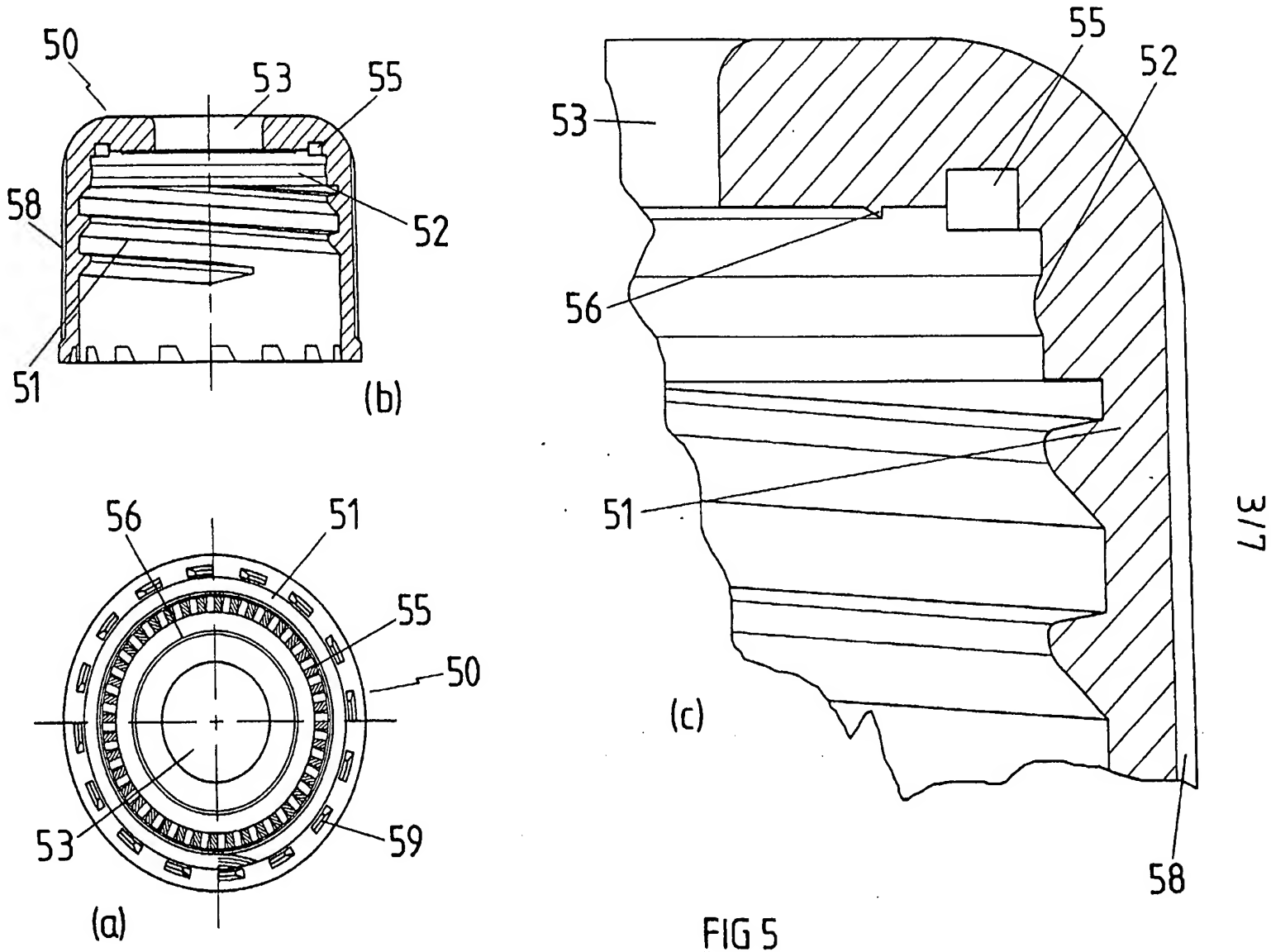


FIG 5

FIG 6

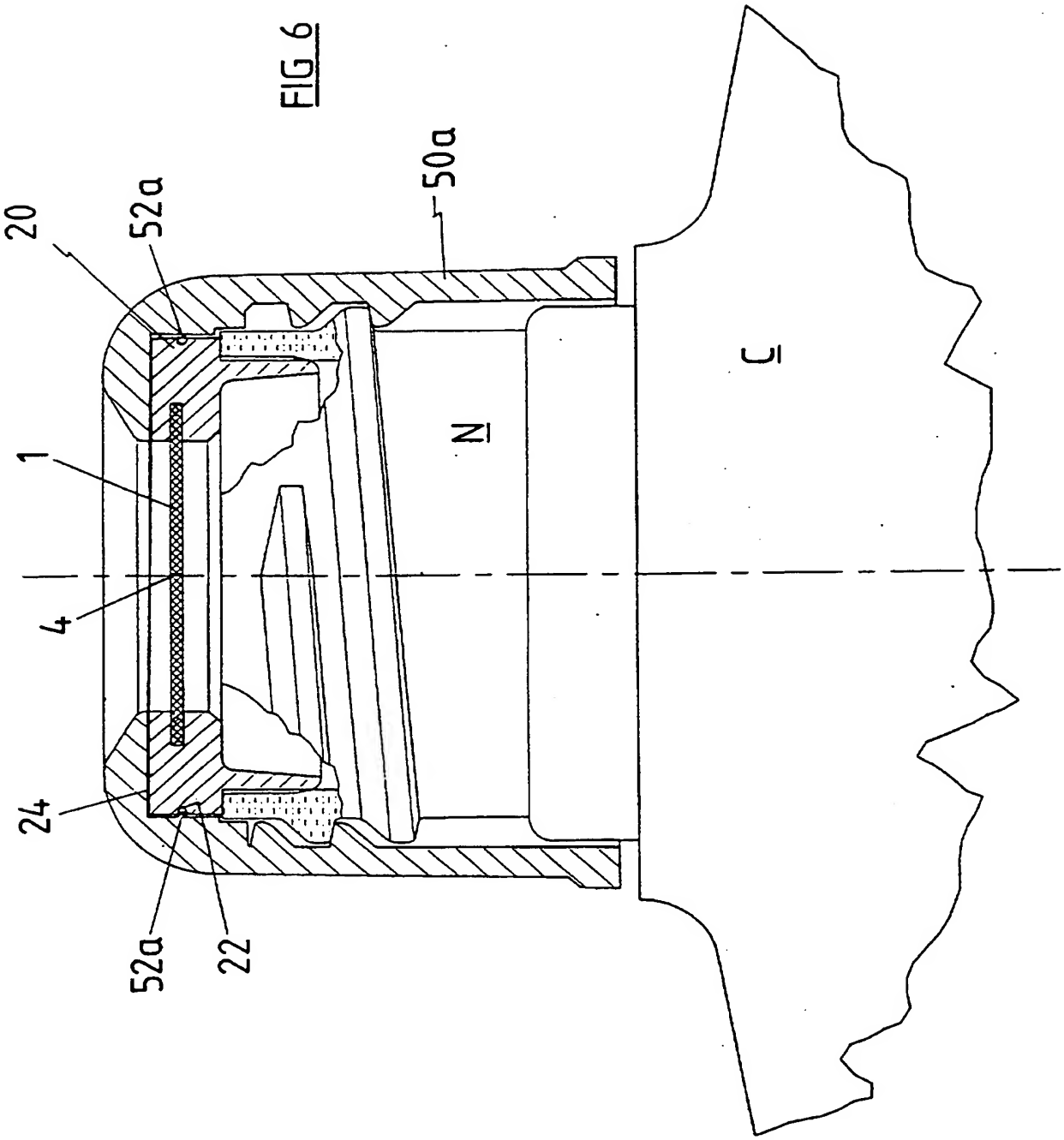
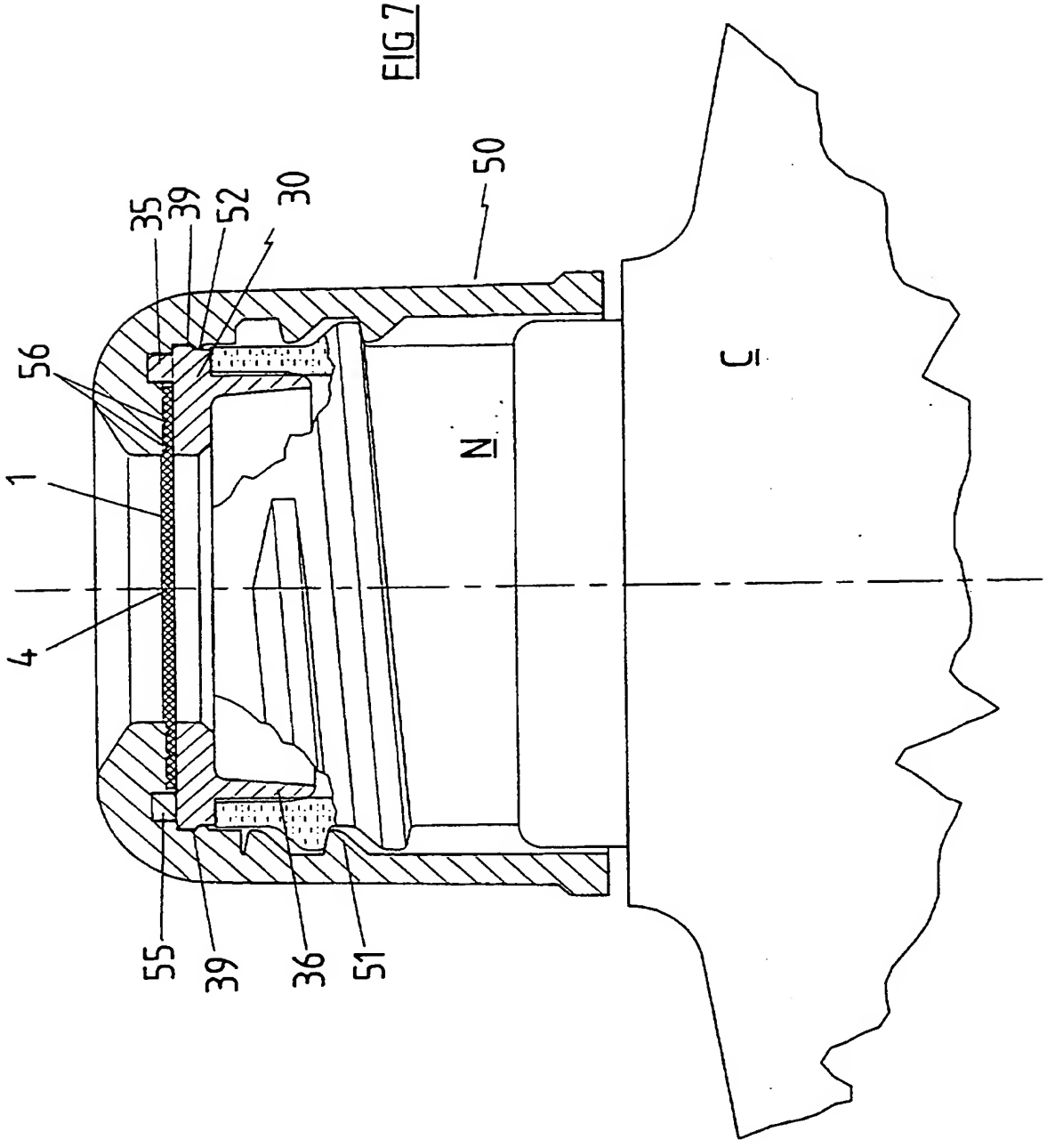


FIG 7



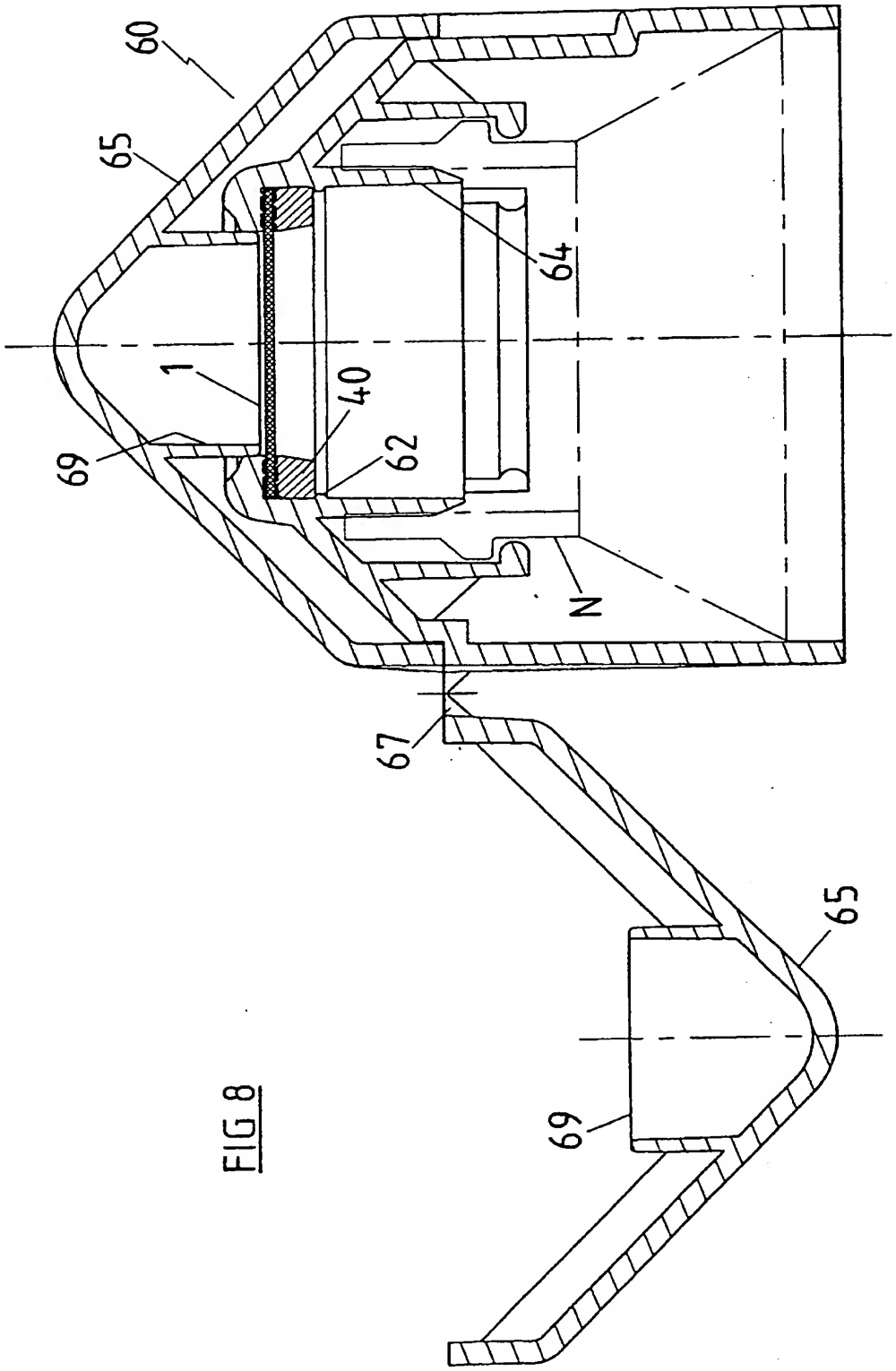


FIG 8

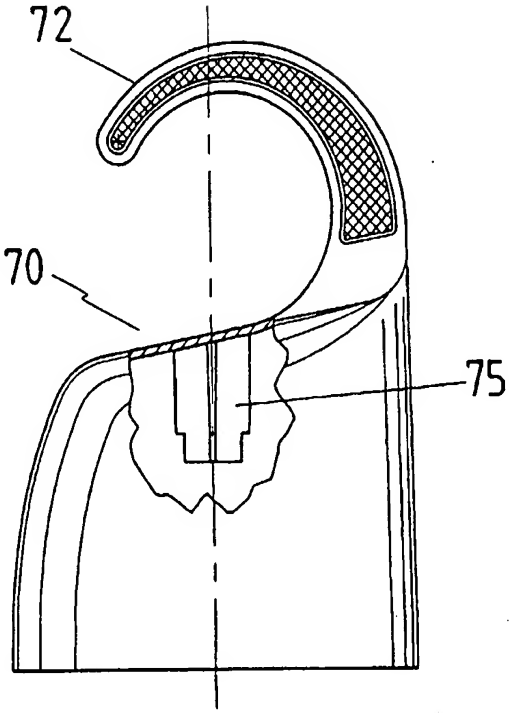


FIG 9

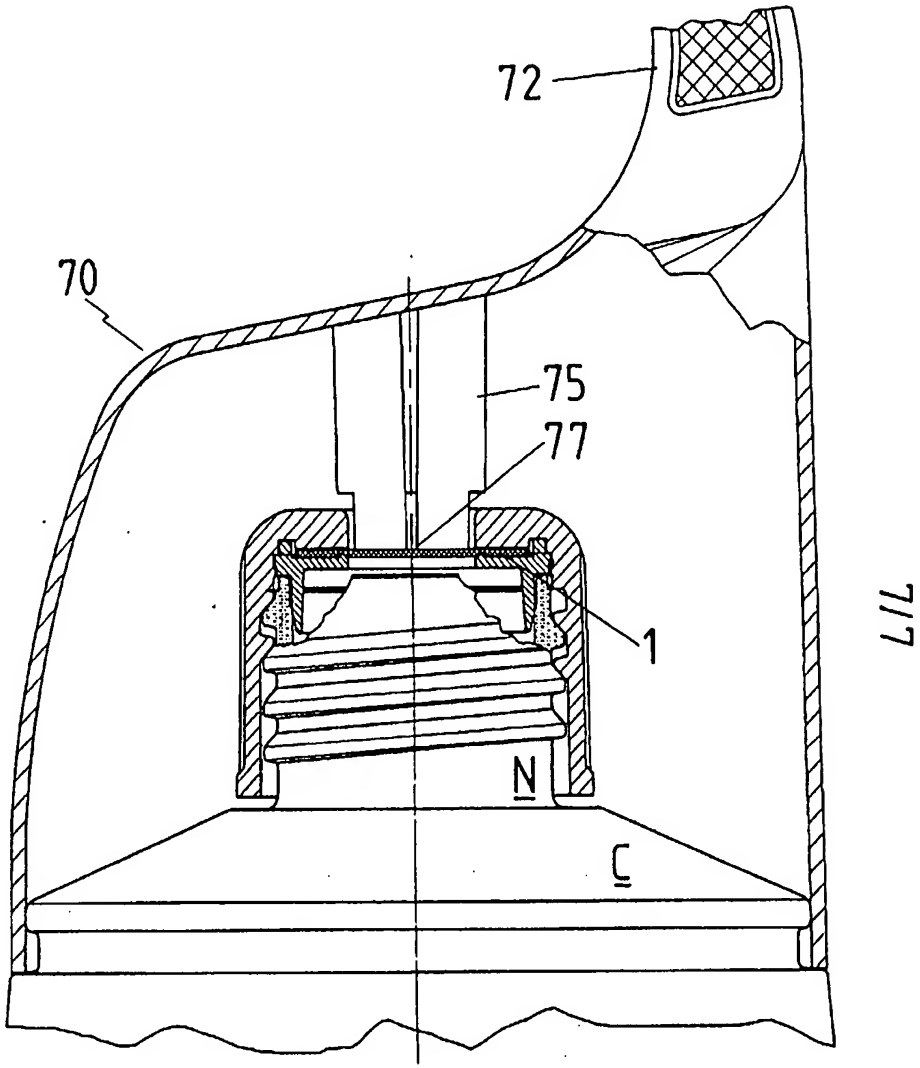


FIG 10

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VALVED CONTAINERS AND CAPS HAVING IMPROVED DISPENSING VALVES

Field of the Invention

The present invention relates to the field of valved containers and caps having valves adapted to dispense viscous fluids, pastes or powders. The invention also relates to containers for storing and dispensing materials of various types and to containers including dispensers which are intended for use in an inverted position.

Background to the Invention

Storing and dispensing containers manufactured from plastics materials or similar resiliently deformable materials become increasingly popular over the past number of years, particularly for containing liquids, suspensions, pastes of various viscosities, powders and the like. Additionally, collapsible tubes such as thin-walled metal tubes have declined in popularity with the advent of resiliently deformable tubes, for example, as used in storing and dispensing toothpastes.

It is well-known that it is desirable for packages or containers of soap, shower gel shampoo or other viscous fluids or powders to be designed in such a way that they may normally be used in an inverted position.

In this way, they may be conveniently used in a shower for example, whereby normally the container hangs in an inverted position and, when the product is required, the container can be squeezed to dispense the product in a single-handed action.

The container will usually be supplied with an overcap of some form to protect the dispenser during storage and shipment but, for maximum convenience, this overcap is removed when the container is placed in its inverted, ready-to-use position. It is thus essential that the dispensing means is leak-resistant so as to avoid leakage of the product when not required, for example whilst the container is hanging in a shower cubicle.

Various types of self-sealing dispensing valves are known, for example that described in US patent number 5,632,420 (ZELLER PLASTIK INC).

In that document, a relatively complex self-sealing dispensing valve is described in which a normally concave silicone rubber valve has cross-slits therein which define pie-shaped flaps. In use, when a bottle incorporating such a valve is squeezed, the concave valve "pops" outwardly into a convex position, opening the pie-shaped flaps through which product can then be dispensed.

This arrangement, although working successfully, is relatively complex to manufacture and hence relatively expensive. There is thus a need for a simple and cheap to manufacture self-sealing dispensing valve which performs the required function. A further disadvantage associated with the "popping" action is that material is occasionally "spat" from the valve. This is undesirable as it may lead to inadvertent eye injury.

Terms such as "bottle", "package", "tube" etc are used throughout this specification as examples only of the generic term "container" and are not intended to be limiting.

Summary of the Invention

In its broadest aspect, the present invention provides a self-sealing dispensing valve for dispensing material such as viscous fluid or powder from a resiliently deformable container, the valve comprising a resilient diaphragm having a slit therein, the diaphragm being movable between a normally closed position in which the slit is sufficiently closed to prevent passage of material therethrough, and an open position in which the slit is urged to open sufficiently to allow

passage of material therethrough, the valve including a diaphragm supporting retention ring having a peripheral member adapted to engage the dispensing aperture of a container.

The peripheral member of the retention ring is an outer peripheral surface adapted to engage the inner surface of the neck of a container so as to mount the valve within the container.

Optionally, an inner peripheral surface of the retention ring is adapted to engage the neck of a container.

Advantageously, the resilient diaphragm has a single substantially straight slit therein.

Preferably, the diaphragm of the self-sealing dispensing valve is substantially planar in its normally closed position. When material is urged through the diaphragm slit, the diaphragm assumes a convex shape, bulging outwardly in the direction of travel of the material passing therethrough.

The invention further provides a closure cap suitable for a dispensing opening of a resiliently deformable container, the cap comprising an internally threaded body operable to engage a correspondingly threaded neck of a container, the body defining a passage therethrough for communicating material in a container through a dispensing aperture in the body in use, the aperture having positioned thereacross a dispensing valve comprising a flexible diaphragm in which the diaphragm is retained adjacent or against the aperture by a retention ring having a peripheral surface adapted to engage the inside of the body adjacent the aperture and hold the diaphragm in fixed relationship thereto.

On a first side of the retention ring, protrusions are provided adjacent the circumferential edge of the ring, the protrusions being adapted to engage an inner surface of the body about the dispensing aperture.

Preferably, within the circumferential protrusions, an annular land is provided to support the diaphragm, the inner edge of said land being co-axial with the dispensing aperture of the cap body in use.

The circumferential protrusions aid locking of the retention ring to the cap and ensures that as the threaded body of the cap is screwed onto the correspondingly threaded portion of a container, the resultant twisting motion is not imparted to the flexible diaphragm thus avoiding distortion of the slit, impairing the operation thereof.

Advantageously, on the retention ring, a rim adapted to engage the open neck of a container is provided.

Push and friction fitting of the retention ring to a closure cap or container neck is facilitated using locking beads and corresponding grooves.

According to another aspect of the present invention there is provided a resiliently-deformable container incorporating a self-sealing dispensing valve substantially as described above.

The present invention is intended to include within its scope a diaphragm for use in combination with a retention ring to form a self-sealing dispensing valve substantially as herein described.

The invention is also intended to include within its scope a cap for a resiliently-deformable container incorporating a self-sealing dispensing valve.

Brief Description of the Drawings

The present invention will now be described more particularly with reference to the accompanying drawings which show, by way of example only, preferred embodiments of the invention. In the drawings:

Figures 1a and 1b are a plan view and a side elevation respectively of a diaphragm for use in a valve according to the invention;

Figures 2a and 2b are sectional side elevations of a first and second embodiment of retention ring having a diaphragm clamped therein;

Figures 3a, 3b, and 3c are a plan view, a sectional side elevation and a detailed view of the sectional side elevation of Figure 3b, respectively of a third embodiment of retention ring;

Figure 4 is a sectional side elevation of a fourth embodiment of retention ring;

Figures 5a, 5b and 5c are a bottom plan view and a sectional side elevation and a detailed side elevation, respectively of a preferred construction of container cap;

Figure 6a is a side elevation, partially in section, of a container cap modified for use with a valve formed using the second embodiment of retention ring;

Figure 7 is a side elevation, partially in section, of the preferred construction of container cap incorporating a valve formed using the third embodiment of retention ring;

Figure 8 is a sectional side elevation of a container cap incorporating a valve formed using the fourth embodiment of retention ring;

Figure 9 is a side view, partially in section of an overcap incorporating a central spigot adapted to engage the self-sealing dispensing valve of a container cap according to the invention; and

Figure 10 is a detailed side elevation of the overcap in use.

Description of the Preferred Embodiments

Referring to drawings and initially to Figure 1, the self-sealing dispensing valve of the present invention essentially comprises a resilient circular diaphragm or "wad" 1. In preferred arrangements, the diaphragm 1 is provided with a single straight slit 4 through which product can be dispensed, as will be described in more detail hereinafter.

It is a particular advantage of the present invention that a flat or planar diaphragm 1 is used as part of the self-sealing dispensing valve. In the majority of prior art devices (not shown) a moulded concave valving diaphragm is required, adding significantly to costs and requiring high manufacturing tolerances. The diaphragm 1 of the invention is made by stamp-cutting a sheet of relatively thin flexible polymeric material such as rubber or silicone. Due to the nature of the diaphragm material it is necessary to support the diaphragm in use to construct an efficient self-sealing dispensing valve.

Referring now to Figures 2a and 2b, first and second embodiments of retention ring 10, 20 are shown. In each case the diaphragm 1 is captively supported in the ring 10, 20. The first embodiment of retention ring 10 has an inner diameter which is less than the outer diameter of the diaphragm 1 while being greater than the length of the centrally disposed slit 4. The outer diameter of the retention ring 10 is suitably sized and shaped to fit into the neck of a bottle or other container so that the dispensing orifice of the bottle is completely blocked by the retention ring 10 and the diaphragm supported therein. The self-sealing dispensing valve formed by the combination of the retention ring 10 and the diaphragm 1 may be secured to the container by a variety of means known to the skilled artisan.

In a preferred arrangement the bottle or container neck includes a bead adapted to engage a bead receiving groove 12 circumferentially disposed on the outer peripheral side wall 14 of the retention ring 10. Thus, the dispensing valve may be frictionally engaged to a container by push fitting. The second embodiment of retention ring 20 shares many common features with the first embodiment 10 described above for example, a groove 22 in its outer peripheral wall 24. The retention ring is modified in that it includes an annular flange 26 depending therefrom, the flange 26 being so sized and shaped to fit into or over the neck of a suitable bottle or container. The flange size is dependent on the diameters set for the inner 27 and outer 29 peripheral walls of the flange 28. On the inner wall of the peripheral flange a bead receiving groove 28 is provided to facilitate frictional or push fitting engagement to the neck of a bottle having a corresponding bead thereabout. It will be appreciated that this construction of valve may be used with a wide range of containers as it may be adapted for use with containers of various different diameters. For example, the valve may be used with the neck of

containers having either an inner diameter approximately equal to the diameter of the outer peripheral side wall 24, of the retention ring 20 or the outer peripheral wall 29 of the flange 26 and containers whose neck has an outer diameter substantially equal to the diameter of the inner peripheral wall 27 of the flange 26. Additionally, as this embodiment (and the embodiment shown in Figure 2a) is adapted for use with the cap, as will be shown hereinafter, the range of containers that the dispensing valve may be used with will depend only on the constructional limitations imposed on the cap.

Referring now to Figures 3a to 3c, a third embodiment of retaining ring 30 adapted for use with a bottle cap is shown. The ring 30 defines a dispensing aperture 32 and an annular land 34 for carrying and supporting a diaphragm (not shown). Beyond the annular land 34, a concentric ring of serrations 35 is provided firstly to provide a reference position for the diaphragm and secondly to engage corresponding serrations or like features in a bottle cap. The operation of the serrations 35 will be described in more detail with reference to Figure 7. Peripheral features such as a depending flange 36 having a bevelled edge 36a, a retaining bead 37 and/or a stepped profile the outer wall of the retention ring 30 facilitate its use with a bottle cap and its positioning against the neck of a bottle or container.

Referring now to Figure 4, a simplified embodiment of a retention ring 40 is illustrated. Similarly to the third embodiment of retention ring 30, the diaphragm 1 is merely supported by the ring and is not held. An annular support land 44 is provided on the retention ring 40 and a series of barbs 45 is included to secure the diaphragm 1 in position when in use.

Figure 5 illustrates a cap 50 modified for particular use with the third embodiment of retention ring 30. The cap 50 has an internally screw threaded body 51 formed to engage a correspondingly screw threaded neck of a container. On the upper inner region of the cap body 51 a bead 52 is provided to engage a corresponding groove or profile feature 39 in a valve retention ring 30. The cap body 51 is provided with a dispensing orifice 58 against which the diaphragm is held. Serrations 55 are provided about the dispensing orifice 53 to engage the corresponding serrations 34 on the retention ring 30. The cap may include a

number of additional features to aid use thereof and enhance its efficiency. Between the serrations 55 and the dispensing orifice 53 a diaphragm engaging crest 56 is provided to clamp the diaphragm between the retaining ring 30 and the upper inner surface of the cap. Additional enhancing features may include a series of equi-spaced splines 58 about the outer peripheral wall of the cap 50 to enhance the users grip with wet hands. Additionally, anti-rotation dogs 59 are provided at the base of the cap as an unscrewing aid.

Figures 6 to 10 show self-sealing dispensing valves as described hereinabove in use with resiliently deformable containers C. Such containers C are preferably made from thermoplastics material and have necks N which are either externally screw threaded for engaging a dispensing cap or having necks N which are profiled to retain a retention ring by friction fitting or push fitting the rings against suitably profiled internal or external neck surfaces. In this way, the diaphragm 1 may be extended across the dispensing aperture of the subject container C.

Referring now to Figure 6, a self-sealing dispensing valve is held to the neck N of a container C. The self-sealing dispensing valve illustrated comprises a slit diaphragm 1 supported by the second embodiment of retention ring 20. The retention ring is held to the container neck N by a modified screw threaded cap 50a (similar that to the cap 50 shown in Figure 5). The valve is held within the bottle cap 50a by means of a retaining bead 52a which engages the corresponding bead receiving groove 22 in the outer peripheral wall 24 of the retaining ring 20. The flange 26 of the retaining ring 20 is so formed to allow the valve to be friction fitted to the neck N of the container C after filling and the cap 50a is subsequently be screwed down over the neck N and valve. The dispensing valve is then be frictionally coupled to the cap 50a so that on subsequent opening of the bottle cap the valve will be retained therein. Normally however the valve will simply be push fitted into the cap 50a and stored in this configuration until required.

Figure 7 illustrates the preferred arrangement of the present invention. In this construction the cap 50 illustrated in Figure 5 retains a self-sealing dispensing valve, comprising a diaphragm 1 and the third embodiment of retention ring 30, to the screw threaded neck N of a container C. It is imperative for the correct operation of the valve that the diaphragm 1 is not distorted when it is coupled to

the cap 50. If distortion occurs the diaphragm slit 4 opens, sealing is not effected and leaking may occur. To ensure that no distortion of the diaphragm 1 occurs, the retention ring 30 and cap 50 are formed with corresponding features to ensure that no twisting motion is imparted to the diaphragm 1. In the instance where the cap 50 and valve are combined prior to use with a container C, the diaphragm 1 is placed on the supporting land 34 of the ring 30 and the combined retention ring 30 and diaphragm 1 are pushed, without twisting, into the body 51 of the cap. In most instances this action will be sufficient to ensure that friction fitting between the cap bead 52 and one of the regions of the stepped profile 39 of the ring 30 is complete. Where friction fitting is not complete, the serrations 35 of the retention ring 30 will engage the corresponding serrations 55 in the cap 50 so that as the threaded cap body 51 is screwed on to the correspondingly threaded neck N of a bottle or container C, the retention ring 30 will be urged into final contact with the upper region of the cap body 51 without translating any of the rotational movement to the diaphragm 1. Similarly where the flange 36 of the retention ring 30 is firstly placed in to the neck N of the container C and the diaphragm 1 is subsequently positioned on the annular land 34, when the cap 50 is screwed down over the valve the corresponding serrations 55, 35 on the cap 50 and retaining ring 30 will engage forcing the retention ring 30 to rotate within the neck N until the cap 50 is firmly screwed into position. One or more beads or barbs 56 on the upper inner surface of the cap body 56 is provided to clamp the diaphragm 1 in position. Thus, distortion of the diaphragm 1 is avoided by ensuring that relative rotational movement between the cap 50 and the retention ring 30 is not facilitated.

A further embodiment of bottle cap 60 is shown in Figure 8 which includes a self-sealing dispensing valve comprising a diaphragm 1 and the fourth embodiment of retention ring 40. The retention ring 40 and diaphragm 1 are simply placed in position and friction fitted over a bead 62 positioned within inner walls 64 of the cap 60. The cap is formed to be pushed connected onto the neck N of a bottle (shown in dotted lines). The cap which is formed from a plastics material includes an overcap 65 which is moveable around a hinge 67 from an open position to a closed position in which a central spigot 69 of the overcap 65 abuts the diaphragm 1 of the valve, thereby protecting the diaphragm 1 and preventing inadvertent spillage of the container contents.

Finally, with reference to Figures 9 and 10, an overcap 70 with a hook 72 of the type generally known is provided. When used with appropriate containers C the overcap 70 is used to suspend a container in an inverted position for use and is also used to seal the container against inadvertent leaks during rough handling for example, during shipping. The overcap 70 is provided with a centrally disposed inner spigot 75 which is adapted to engage a diaphragm 1 of a self-sealing dispensing valve according to the invention. The spigot 75 includes a cross member 77 which abuts the diaphragm 1 preventing the slit 4 from opening even if material is urged from the container towards the valve.

The overcap is normally adapted to retain the container in an inverted position. It will be appreciated that even when the container or bottle is full of the product to be dispensed, the internal pressure on the valve is insufficient to cause the slit to open. Thus, no leaking of the product occurs.

It will be appreciated by the skilled reader that the closure cap 50, 50a may be modified to include a lid hingedly attached thereto, the lid including an "active" hinge and a diaphragm engaging spigot.

When it is desired to dispense the product, manual pressure is applied to the outside of the container C, deforming it so as to increase the pressure in its interior. This increase in pressure causes the planar diaphragm 1 to bulge outwardly, sufficient for the slit 4 to open and permit the product to be dispensed. On release the resilient container C returns to its original shape, thus reducing the pressure in its interior. This causes the diaphragm 1 to return to its planar shape, venting air back into the container, closing off the slit 4 and substantially preventing further dispensing of the product (or leakage). More particularly, when the bottle is released to close the valve, there is a sudden pressure differential between the inside of the container and the outside as the container tends to resume its "fully reflated" state. This causes the diaphragm 1 to invert, that is assume a slightly convex state beyond its normal planar mode. As the bottle resumes its "fully reflated" state (which happens over time) a further negative pressure reopens the slit 4 allowing air to vent back into the container. As pressure equilibrium is restored, the valve diaphragm 1 resumes its planar state.

The self-sealing dispensing valve of the present invention is thus of much simpler construction than the known prior art and hence cheaper to manufacture. This may be incorporated into tubes and bottles or other containers of various dimensions, for dispensing a wide range of materials including viscous fluids and pastes or powders.

The orientation of use and/or usage of the container may be critical to the working of the invention and particular embodiments are adapted for preferred use in an inverted orientation.

It will of course be understood that the invention is not limited to the specific details described herein, which are given by way of example only, and that various modifications and alterations are possible within the scope of the invention.

CLAIMS

1. A self-sealing dispensing valve for dispensing material such as viscous fluid or powder from a resiliently deformable container, the valve comprising a resilient diaphragm having a slit therein, the diaphragm being movable between a normally closed position in which the slit is sufficiently closed to prevent passage of material therethrough, and an open position in which the slit is urged to open sufficiently to allow passage of material therethrough, the valve including a diaphragm supporting retention ring having a peripheral member adapted to engage the dispensing aperture of a container.

2. A self-sealing dispensing valve as claimed in claim 1, in which the peripheral member of the retention ring is an outer peripheral surface adapted to engage the inner surface of the dispensing aperture of a container so as to mount the valve on or within a container.

3. A self-sealing dispensing valve as claimed in claim 1, in which an inner peripheral surface of the retention ring is adapted to engage the dispensing aperture of a container.

4. A self-sealing dispensing valve as claimed in any one of claims 1 to 3, in which the resilient diaphragm has a single substantially straight slit therein.

5. A self-sealing dispensing valve as claimed in any one of the preceding claims, in which the valve is substantially planar in its normally closed position so that when material is urged through the diaphragm slit, the diaphragm assumes a convex shape, bulging outwardly in the direction of travel of the material passing therethrough.

6. A closure cap suitable for a dispensing opening of a resiliently deformable container, the cap comprising an internally threaded body operable to engage a correspondingly threaded neck of a container, the body defining a passage therethrough for communicating material in a container through

a dispensing aperture in the body in use, the aperture having positioned thereacross a dispensing valve comprising a flexible diaphragm in which the diaphragm is retained adjacent or against the aperture by a retention ring having a peripheral surface adapted to engage the inside of the body adjacent the aperture and hold the diaphragm in fixed relationship thereto.

7. A closure cap as claimed in claim 6, in which, on a first side of the retention ring, protrusions are provided adjacent the circumferential edge of the ring, the protrusions being adapted to engage an inner surface of the body about the dispensing aperture.

8. A closure cap as claimed in claim 7, in which, within the circumferential protrusions, an annular land is provided to support the diaphragm, the inner edge of said land being co-axial with the dispensing aperture of the cap body in use.

9. A closure cap as claimed in claim 6 or claim 7, in which the circumferential protrusions aid locking of the retention ring to the cap and ensure that, as the threaded body of the cap is screwed onto the correspondingly threaded portion of a container so that the resultant twisting motion is not imparted to the flexible diaphragm thereby avoiding distortion of the slit which impairs the operation thereof.

10. A closure cap as claimed in any one of claims 6 to 9, in which a rim adapted to engage the open neck of a container is provided on the retention ring.

11. A closure cap as claimed in any one of claims 6 to 10, in which push or friction fitting of the retention ring to a closure cap or container neck is facilitated using locking beads on the cap or neck and corresponding grooves on the ring or vice versa.

12. A resiliently-deformable container incorporating a self-sealing dispensing valve substantially as defined in any one of claims 1 to 5.

13. A diaphragm for use in combination with a retention ring to form a self-sealing dispensing valve substantially as defined in any one of claims 1 to 5.

14. A cap for a resiliently-deformable container, the cap being adapted so as to incorporate a self-sealing dispensing valve substantially as defined in any one of claims 1 to 5.

15. A self-sealing dispensing valve substantially as herein described with reference to and as shown in any one of Figures 2, 4, 6, 7, 8 and 10 of the accompanying drawings.

16. A closure cap substantially as herein described with reference to and as shown in any one of Figures 5, 6, 7, 8 and 10.

17. A diaphragm having a dispensing slit substantially as herein described with reference to and as shown in Figures 1, 2, 4, 6, 7, 8 and 10 of the accompanying drawings.

18. A retention ring for supporting a valve diaphragm substantially as herein described with reference to and as shown in any one of Figures 2, 3, 4, 6, 7, 8 and 10 of the accompanying drawings.

The Patent Office

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INVESTOR IN PEOPLE

Application No: GB 9823002.2
Claims searched: 1-18

Examiner: Michael Logan
Date of search: 21 January 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): B8T (TWG, TWQ)

Int Cl (Ed.6): B65D 47/20

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 621427	(COPPLE) see figs 1-5	1,3-6, 12-14
X	EP 0591601 A1	(PROCTER & GAMBLE) see figs 1-5	1,3,4,6,10 12-14
X	EP 0495440 A2	(PITTWAY) see figs and col 16, lines 10-20	1-3,6, 10-14
X	EP 0405472 A1	(PITTWAY) see figs 1-4	1,3,4,6,9, 10,12-14
X	US 5655687	(FITTEN) see fig 5	1,2,6-8,10 12-14
X	US 5071017	(STULL) whole document relevant	1,3-6,10, 11-14

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.